

# Radioactive UHECR Astronomy: Correlating gamma anisotropy and neutrino PeV events

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## Abstract

UHECR (Ultra High Energy Cosmic Rays) were expected to be protons, to fly straight and to suffer of a GZK (opacity on CMB radiation) cut off. AUGER did suggest on 2007 that such early UHECR anisotropy was compatible with the foreseen Super-Galactic plane while both HIRES and AUGER confirmed such *apparent* GZK cut-off in the spectra. However the same AUGER composition since 2007 was favoring nuclei (and not nucleon). The recent absence of narrow angle clustering in UHECR maps, as it should be expected by protons, the missing of events along nearest Cluster Virgo, the wide spread ( $16^\circ$ ) angle of UHECR along Cen A are in disagreement with first proton-UHECR AUGER understanding. We claimed since 2008 a light nuclei role for Cen A crowded area. On the other side the ICECUBE absence of TeVs neutrino clustering or anisotropy, its spectra steepening is favoring mostly a ruling atmospheric neutrino noise up to tens TeV. However recent two PeV neutrino event cannot easily coexist or being extrapolate with such atmospheric ruling scenario, nor with GZK (either nucleon or nuclei) secondaries expected spectra. Finally tens TeV gamma anisotropy in ARGO-MILAGRO -ICECUBE maps may hardly be associated with known hadronic sources. We imagine such anisotropy ruled by diffused gamma secondaries, being shine along UHECR bending and flight: radioactive light and heavy UHECR nuclei, while decaying in flight, may paint in the sky (by gamma, electrons and neutrinos) their trajectories and bending, connecting UHECR spread events with TeV anisotropy, as well offering a very realistic source of first, otherwise puzzling, observed PeV neutrinos.

**Keywords:** Cosmic Rays, Neutrino, GZK cut off.

## 1 Introduction

Ultra High Energy cosmic Rays (UHECR) and UHE neutrino Astronomy are the two among the hot frontier of present High Energy Astrophysics. Since half a century we were expected to detect UHECR from near Universe (because of photon-nucleon GZK cut off opacity due to cosmic radiation) and along their straight trajectory, because of highest proton rigidity. Almost five years ago AUGER experiment claimed in their abstract that " *they demonstrated a correlation between the arrival directions of cosmic rays with energy above 60 EeV electron volts and the positions of active galactic nuclei (AGN) lying within 75 megaparsecs*". Therefore " *They rejected the hypothesis of an isotropic distribution of these cosmic rays with at least a 99% confidence level from a prescribed a priori test. The correlation observed is compatible with the hypothesis that the highest-energy particles originate from nearby extragalactic sources whose flux has not been substantially reduced by interaction with the cosmic background radiation (GZK cut off). AGN or objects having a similar spatial distribution are possible sources*". Unfortunately or nevertheless, more recent maps seem to dismiss this possibility. UHECR

are not well correlated to Super-Galactic Plane; they do not cluster where cluster and AGN sits; in the past following AGASA isotropy maps many attempts were made (as Z-Showering model [7] or heavy relic annihilation [5] to solve the puzzle; moreover now AUGER claim that UHECR are most probably nuclei; we suggested that UHECR are lightest ones for Cen A and-or heaviest ones for most remain events; we also explain here that we believe they are mostly galactic and partially within inner Local Group. Indeed very recent maps in UHECR and their possible secondaries multiplet are offering a relevant Cen A role as the main unique extragalactic UHECR source; other clustering we suspect that they are suggesting local galactic sources. At highest edges (EeV) neutrinos might trace the same proton GZK traces, if UHECR (as most still believe) are proton; in proton-UHECR model, cosmo-genic PeVs neutrinos will be nearly un-detectable today; neutrino will be even poorer if they derive by photo-nuclear fragments of GZK nuclei. On the contrary as we shall show, PeV neutrinos may be born by UHECR EeV radioactive decay nuclei. Icecube and AUGER failed up to now to find EeV GZK neutrino (by proton photo-pion decay) tracing UHECR clustering source. But recent

two isolated PeV events in ICECUBE are probably not atmospheric neutrinos: no muon track it was observed from the PeV cascade; neither EeV GZK neutrinos; UHECR made by radioactive nuclei whose ultra-relativistic shine at PeV-TeV may fit the picture. UHECR relics at latest non relativistic stages may be also tracing by eventual radioactive decay (Co, Ni) at MeV; but at earlier boosted stage in flight they may shine the UHECR tracks as a correlated TeVs gamma anisotropy; the same UHECR beta decay in neutrinos may be source of two recent PeV discover. Therefore maybe UHECR decays trace UHE TeV gamma maps, while ICECUBE PeV neutrino relics, probably of tau and electrons flavor, may be their associated signature.

### 1.1 A century of cosmic rays

The last two decades of high energy astrophysics puzzled us with an Ultra High Energy Cosmic ray (UHECR) spectra and mysterious maps. After first huge Fly's Eye event (1991), later AGASA UHECR absence of GZK cut off made theoreticians speculate in new physics. More recent HIRES (2005) and AUGER spectra seemed to confirm spectra and since 2007 (AUGER,2007) also anisotropy map along nearby GZK volumes. However more recent maps and more composition signatures are in strident contradiction with this latter hoped goal: today UHECR by AUGER does'nt follow much the UHECR nearby (GZK cosmic volume) mass distribution. On the other side some remarkable (20%) event clustering remains along nearest AGN: Cen A. However common proton carrier UHECR (single charge) would be more collimated  $3^\circ - 4^\circ$ , while the clustering is spread by  $10^\circ - 15^\circ$  along the Cen A source. The spread is en-longed vertically respect the galactic plane. We suggested that such tail of events are made mostly by UHECR He nuclei. Their fragments in flight, we argued three years ago, would fragment into lower energy fifteen EeV secondaries (protons,neutrons,D); such train of UHECR multiplet have (probably) been observed last year by AUGER along Cen A, with poor ( $3 \cdot 10^{-5}$ ) probability to occur by chance. More recent clustering of UHECR along different radio, gamma maps did force us to imagine a way to associate UHECR with TeV gamma anisotropy. We found that this is possible assuming that UHECR are partially lightest nuclei (extragalactic) and mostly in very local universe, even galactic. This UHECR connection with PeV gamma spread maps is possible because lightest UHECR secondaries from Cen A are made also by neutrons whose decay in flight is showing into tens PeV electrons followed by PeV-TeV gamma; heaviest UHECR nuclei in our galaxy may be radioactive and they may be decaying in flight also in gamma and electrons radiating by Lorentz boost

into PeVs energy ranges. The UHECR may contain both nuclei (lightest and heaviest) offering such a behavior. As a consequence, contrary to a general accepted believe, we, probably, didn't yet observe the real GZK cut off.

## 2 Main UHECR lessons

There are few clear lessons from last UHECR maps and spectra and composition: 1) UHECR are not mostly protons; indeed there are not multiplet narrow clustering within a few degree angle as expected by protons; we did find a doublet near Cen A and a twin highest hundred EeV along the Galactic Plane, but most few clustering are spread in long smeared tail. AUGER composition shows more nuclei than just protons. Hires,TA are compatible with protons and or light nuclei. 2) Virgo, the nearest and most abundant crowded region of AGN sources within our GZK volume is absent, see Fig. 2; (that sky region is partially suppressed by AUGER detection, but the event paucity call for an answer): light nuclei as UHECR carrier, being opaque to CMB radiation, may explain the main Virgo UHECR event absence. 3) The size (and strip en-longed) form of few UHECR clustering favors light-heavy charge (heavy nuclei) bent by galactic magnetic fields, see Fig. 1,3. 4) The absence of Super-galactic plane correlation may favor a more local sky, as a few tens EeV multiplet along Cen A and Magellanic Stream suggest. Indeed the Planck dust cloud region, mostly galactic, are the ones where UHECR occur abundantly, see Fig. 3. There are also remarkable correlation between UHECR events and the neutral H map, , see Fig. 4. 5) The observed UHECR GZK cut off may be very well an UHECR composition change steepening at different energies range. Therefore the consequent expected GZK cut off may be even less relevant than the expected one. The consequences of the absence of any GZK cut-off in the Neutrino sector are even more radical: the suppression of cosmogenic neutrino flux at a level (already) non compatible with the observed twin PeV events in ICECUBE in last two years [25], [8]. These events are not probably of atmospheric nature (because of the lower extrapolated atmospheric flux and the absence of the associate muons at PeV events), nor of resonant W boson nature. This neutrino paradox (suppression by one or two order of magnitude respect to expected GZK flux) may put a shadow on a UHE neutrino Astronomy finally at its birth.

However as we offer here, there are additional ways to produce PeV neutrinos: one is at their birth along the source itself by hadronic secondaries [25]. This point-like source must be also observed by a growing inhomogeneity in neutrino maps. Very recent richest map (hundred thousands events) in ICE-

CUBE do not exhibit such clustering [1]. A different source of UHE neutrino may rise during the SNR or GRB jet emission: UHECR heavy radioactive nuclei may rule (as observed) the SN peak optical luminosity for weeks and the fast parental decay boosted at high Lorentz factor (a billion) of UHECR nuclei like Ni, may also shine at PeV neutrino and electron tails, as discussed in next paragraph, as well as at lower TeVs gamma energies because of the PeV electron synchrotron radiation. These radioactive tails, as the one observed by ARGO at TeVs along Crab and in nearby areas, maybe smeared and non point-like, explaining at once the presence of PeV neutrino events and the absence of Tens TeV neutrino clustering. The TeVs neutrinos anisotropy might rise smeared as for the ARGO-MILAGRO anisotropy at an energy deviation as small as  $10^{-4}$ , corresponding to a flux density of the order of  $\simeq 100 \text{ eV cm}^{-2} \text{ s}^{-1} \text{ sr}^{-1}$ . The idea to feed by UHECR radioactive in flight TeVs anisotropy is discussed below.

Among the last AUGER lessons are the few multiplet clustering at tens EeV energy range, whose meaning and fate is simply forgotten by most authors. Two of these multiplet cluster along Cen A, see Fig. 1.

## 2.1 Bending for He UHECR and fragments at 20 EeV along Cen A

The very recent multiplet clustering published last year by AUGER at twenty EeV contains just three and apparently isolated train of events with (for the AUGER collaboration) no statistical meaning. [23]. Indeed apparently they are pointing to unknown sources (See Fig. 1). However the crowding of the two train multiplet tail centers inside a very narrow disk area focalized about the rarest Cen A UHECR source is remarkable, [11]. If UHECR are made by proton (as some AUGER author believe) they will not naturally explain such a tail structure because these events do not cluster more than a few degree, contrary to observed UHECR and associated multiplet. Our He-like UHECR do fit the AUGER and the HIRES composition traces. The He secondaries are splitting in two (or a fourth) energy fragments along Cen A tail whose presence has being foreseen and published many times in last years[24],[11]. Indeed the dotted circle around Cen A containing the two (of three) multiplet has a radius as small as  $7.5^\circ$ , it extend in an area that is as smaller as 200 square degrees, below or near 1% of the observation AUGER sky. The probability that two among three sources fall inside this small area is offered by the binomial distribution.

$$P(3, 2) = \frac{3!}{2!} \cdot (10^{-2})^2 \cdot \frac{99}{100} \simeq 3 \cdot 10^{-4}$$

Moreover the same twin tail of the events are aligned almost exactly  $\pm 0.1$  rad along UHECR train of events toward Cen A. Therefore the UHECR multiplet alignment at twenty EeV has an a priori probability as low as  $P(3, 2) \simeq 3 \cdot 10^{-5}$  to follow the foreseen signature[11]. The incoherent random angle bending (2) along the galactic plane and arms,  $\delta_{rm}$ , while crossing along the whole Galactic disk  $L \simeq 20 \text{ kpc}$  in different (alternating) spiral arm fields and within a characteristic coherent length  $l_c \simeq 2 \text{ kpc}$  for He nuclei is

$$\delta_{rm-He} \simeq 16^\circ \cdot \frac{Z}{Z_{He^2}} \cdot \left( \frac{6 \cdot 10^{19} \text{ eV}}{E_{CR}} \right) \left( \frac{B}{3 \cdot \mu G} \right) \sqrt{\frac{L}{20 \text{ kpc}}} \sqrt{\frac{l_c}{2 \text{ kpc}}}$$

The heavier (but still light nuclei) bounded from Virgo might be also Li and Be:  $\delta_{rm-Be} \simeq 32^\circ \cdot \frac{Z}{Z_{Be^4}} \cdot \left( \frac{6 \cdot 10^{19} \text{ eV}}{E_{CR}} \right) \left( \frac{B}{3 \cdot \mu G} \right) \sqrt{\frac{L}{20 \text{ kpc}}} \sqrt{\frac{l_c}{2 \text{ kpc}}}$ . It should be noted that the present anisotropy above GZK [6] energy  $5.5 \cdot 10^{19} \text{ eV}$  (if extragalactic) might leave a tail of signals: indeed the photo disruption of He into deuterium, Tritium,  $He^3$  and protons (and unstable neutrons), rising as clustered events at half or a fourth (for the last most stable proton fragment) of the energy: *protons being with a fourth an energy but half a charge He parent may form a tail smeared around Cen-A at twice larger angle* [11]. We suggested to look for correlated tails of events, possibly in strings at low  $\simeq 1.5 - 3 \cdot 10^{19} \text{ eV}$  along the Cen A train of events. *It should be noticed that Deuterium fragments have half energy and mass of Helium: Therefore D and He spot are bent at same way and overlap into UHECR circle clusters* [11]. Deuterium are even more bounded in a very local Universe because their fragility (explaining Virgo absence). In conclusion He like UHECR may be bent by a characteristic angle as large as  $\delta_{rm-He} \simeq 16^\circ$ ; its expected lower energy Deuterium or proton fragments at half energy ( $30 - 25 \text{ EeV}$ ) are also deflected accordingly at ( $\delta_{rm-p} \simeq 16^\circ$ ); protons last traces at a quarter of the UHECR energy, around twenty EeV energy, will be bent and spread within ( $\delta_{rm-p} \simeq 32^\circ$ ), within the observed Cen A UHECR multiplet shown in figures, see Fig. 1.

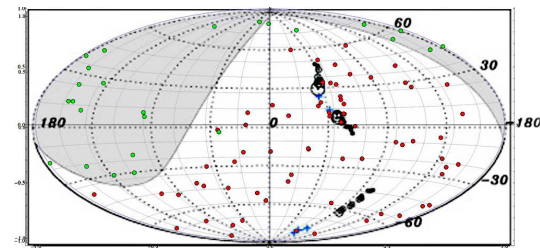


Figure 1: The very last UHECR event maps for both AUGER (red disk) and TA (Telescope Array)(green disk) events. AUGER is in the south equatorial side and TA is in the North one. Also three multiplet at 20

EeV are shown. Note the crowding along the unique nearest AGN Cen A; note also a possible multiplet crowding along Large and Small Magellanic Clouds.

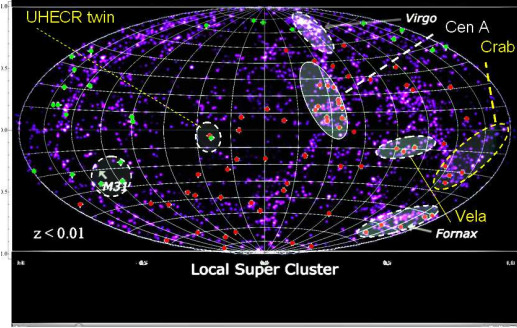


Figure 2: The infrared cosmic map with the UHECR events (AUGER and TA); note the remarkable absence of UHECR at nearest galaxy cluster, Virgo; the presence of a fourth of AUGER events within a narrow sky area along Cen A; the possible crowding along nearest Fornax dwarf galaxy source; along the Orion and Crab areas, and a rare triplet toward M31 and a triplet near Vela, our brightest Fermi gamma SNR and gamma PSR.

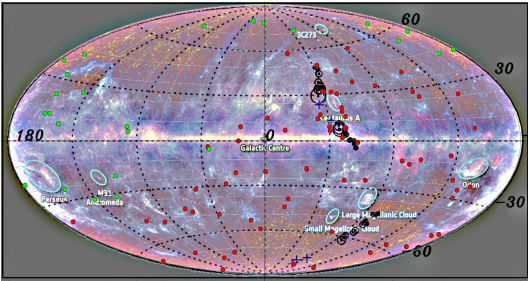


Figure 3: The Planck infrared last maps with both AUGER and TA events. It is remarkable the paucity of UHECR events inside infrared map with little or none galactic dust presence: it may suggest the main role of galactic sources in UHECR.

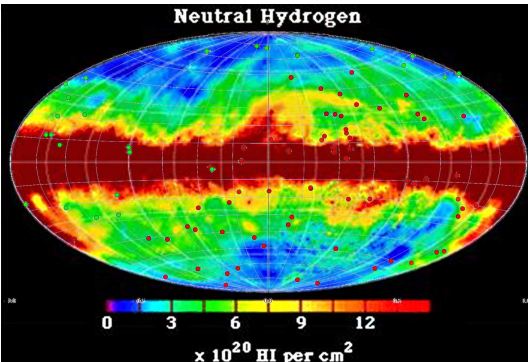


Figure 4: The neutral hydrogen map with the UHECR events: as in previous Planck map the

UHECR are almost absent where there is not galactic hydrogen gas. This peculiarity may favor a very galactic UHECR component.

### 3 TeV Gamma and UHECR

In recent maps of UHECR we noted first hint of galactic source rising as an UHECR triplet [9]. Also the hint by  $Al^{26}$  gamma map traced by Comptel somehow overlapping with UHECR events at 1-3 MeV favors a role of UHECR radioactive elements (as  $Al^{26}$ ). The most prompt radioactive nuclei are the  $Ni^{56}$ ,  $Ni^{57}$  (and  $Co^{56}$ ,  $Co^{60}$ ) made by Supernova (and possibly by their collimated GRB micro-jet components, ejecta in our own galaxy). Indeed in all SN Ia models, the decay chain  $Ni^{56} \rightarrow Co^{56} \rightarrow Fe^{56}$  provides the primary source of energy that powers the supernova optical display, days and weeks later the explosion. The  $Ni^{56}$  decays by electron capture and the daughter  $Co^{56}$  emits gamma rays by the nuclear de-excitation process; the two characteristic gamma lines are respectively at  $E_\gamma = 158$  keV and  $E_\gamma = 812$  keV. Their half lifetime are spread from 35.6 h for  $Ni^{57}$  and 6.07 d. for  $Ni^{56}$ . However there are also more unstable radioactive rates as for  $Ni^{55}$  nuclei whose half life is just 0.212 s or  $Ni^{67}$  whose decay is 21 s. Therefore we may have an apparent boosted ( $\Gamma_{Ni^{56}} \simeq 10^9$ ) life time spread from  $2.12 \cdot 10^8$  s or 6.7 years (for  $Ni^{55}$ ) up to nearly 670 years (for  $Ni^{67}$ ) or 4 million years for  $Ni^{57}$ . This consequent wide range of lifetimes guarantees a long life activity on the UHECR radioactive traces. However, we underline again, the most bright are the fastest decaying ones as  $Ni^{55}$ ,  $Ni^{67}$ . The arrival tracks of these UHECR radioactive heavy nuclei may be widely bent, as shown below, by galactic magnetic fields. Among the excited nuclei to mention for the UHECR-TeV connection is  $Co_m^{60}$  whose half life is 10.1 min and whose decay gamma line is at 59 keV. At a boosted nominal Lorentz factor  $\Gamma_{Co^{60}} = 10^9$  we obtain  $E_\gamma \simeq 59$  TeV; let us remind that a gamma air-shower exhibit a smaller secondary muon abundance with respect to an equivalent hadronic one; therefore a gamma simulates a (10%) hadronic shower ( $E_{\text{gamma-hadron}} \simeq 6$  TeV) nearly corresponding to observed ICECUBE-ARGO anisotropy [20]. The decay boosted lifetime is 19000 years corresponding to 6 kpc distance. Therefore  $Co_m^{60}$  energy decay traces, lifetime and spectra fit well within present UHECR-TeV connection for nearby galactic sources as Vela and (probable) Crab. Other radioactive beta decay, usually at higher energy may also shine at hundred or tens TeV or below by inverse Compton and synchrotron radiation. Therefore their UHECR bent parental nuclei may shine also in TeV Cosmic ray signals. By beta decay processes also electrons and neutrinos are born,



providing a new diffused PeV neutrino source.

## 4 The UHECR galactic bending for $Ni^{57}$

Cosmic Rays are blurred by magnetic fields. Also UHECR suffer of a Lorentz force deviation. This smearing maybe source of UHECR features. Mostly along Cen A. There are at least three mechanisms for magnetic deflection along the galactic plane, a sort of galactic spectroscopy of UHECR [22]. The magnetic bending by extra-galactic fields are in general negligible respect galactic ones. A late nearby (almost local) bending by a nearest coherent galactic arm field, and a random one by turbulence and a random along the whole plane inside different arms:

(1) the coherent Lorentz angle bending  $\delta_{Coh}$  of a proton (or nuclei) UHECR (above GZK [6]) within a galactic magnetic field in a final nearby coherent length of  $l_c = 1 \cdot kpc$  is:

$$\delta_{Coh-p} \simeq 2.3^\circ \cdot \frac{Z}{Z_H} \cdot \left( \frac{6 \cdot 10^{19} eV}{E_{CR}} \right) \left( \frac{B}{3 \cdot \mu G} \right) \frac{l_c}{kpc}$$

(2) the random bending by random turbulent magnetic fields, whose coherent sizes (tens parsecs) are short and whose final deflection angle is smaller than others and they are here ignored;

(3) the ordered multiple UHECR bending along the galactic plane across and by alternate arm magnetic field directions whose final random deflection angle is remarkable and discussed below.

The bending angle value is quite different for a heavy nuclei as an UHECR from Vela whose distance is only 0.29 kpc:  $\delta_{Coh-Ni} \simeq 18.7^\circ \cdot \frac{Z}{Z_{Ni28}} \cdot \left( \frac{6 \cdot 10^{19} eV}{E_{CR}} \right) \left( \frac{B}{3 \cdot \mu G} \right) \left( \frac{l_c}{0.29 kpc} \right)$

Note that this spread is able to explain the nearby Vela TeV anisotropy (because radioactive emission in flight) area around its correlated UHECR triplet. There is an extreme possibility: that Crab pulsar at few kpc is feeding the TeV anisotropy connecting with a gate its centered disk to a wider extended region where some UHECR are clustering. From far Crab distances the galactic bending is:

$$\delta_{Coh-Ni} \simeq 129^\circ \cdot \frac{Z}{Z_{Ni28}} \cdot \left( \frac{6 \cdot 10^{19} eV}{E_{CR}} \right) \left( \frac{B}{3 \cdot \mu G} \right) \left( \frac{l_c}{2 kpc} \right)$$

Note that such a spread is able to explain the localized TeV anisotropy born in Crab (2 kpc) apparently extending around area near Orion, where also spread UHECR events seem clustered 5. Such heavy iron-like (Ni,Co) UHECR, because of the big charge and large angle bending, are mostly bounded inside a Galaxy, as well as in Virgo cluster, possibly explaining the UHECR absence in that direction, see Fig. 2. The possible galactic component of UHECR is suggested by the correlated dark Hydrogen and dust map with the UHECR distribution: see Fig. 3, Fig. 4.

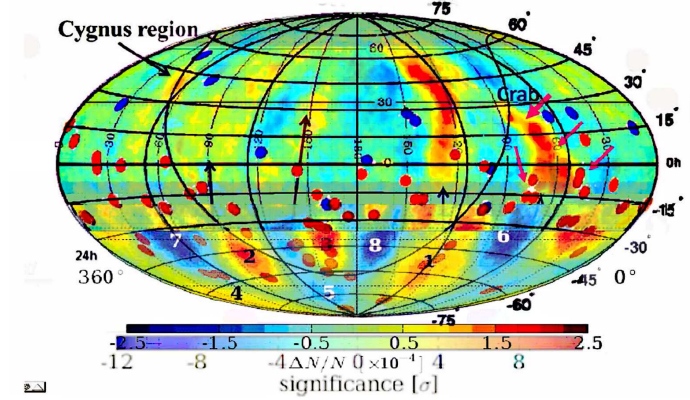


Figure 5: The overlap of the 69 UHECR events by AUGER 2010 and 13 UHECR events by Hires in celestial coordinate. The clustering of UHECR along the red (dense) TeVs sky is remarkable: note the crowded area of events nearby n.6, where Vela is located; note also the crowding of events at the left of n.8, where Cen A is located; note the crowding events along the right side of the map, where Fornax Dwarf Galaxy is located; note some clustering with the galactic plane and nearby Crab and Orion regions; we foresee that the present and future TA and AUGER events will populate respectively the north and south sky area mostly along TeVs anisotropy

## 5 Discussion

The UHECR puzzle maybe at a corner stone: the UHECR-Multiplet along Cen A, the absence of Virgo, the hint of correlation with Vela and with galactic TeV anisotropy [4] [20], might be in part solved by an extragalactic lightest nuclei, mainly He, from Cen A and in part by a galactic heavy radioactive UHECR nuclei. Our predicted [9] and observed [23] multiplet clustering by fragments (D,p) at half UHECR edge energy aligned with Cen A favor such a reading of UHECR map: He like UHECR may be bent by a characteristic angle as large as  $\delta_{rm-He} \simeq 16^\circ$  [11] while their fragments multiplet follow along a tail spread by a wider angle  $\delta_{rm-p} \simeq 32^\circ$  [9],[23]; also neutron beta decay from Cen A may feed a TeV correlated anisotropy. Other UHECR spread events, might be due to a dominant heavy radioactive nuclei component  $Ni^{56}$ ,  $Ni^{57}$  and  $Co^{56}$ ,  $Co^{60}$ , originated by galactic sources (old SNR-GRB relics) as suggested also by relic  $Al$  nuclei at rest in gamma map [11]. UHECR Ni,Co maybe deflected by  $18.7^\circ$  for Vela,  $128^\circ$  (or less) for Crab tuning within TeV inhomogeneities, made by boosted hundred keV gamma and beta positrons decay, shining at TeVs. Inner galactic core UHECR are widely spread and hidden by magnetic fields in dense magnetic galactic core arms. However more clustering around ( $\geq 20^\circ$ ) the

galactic plane far from the core, is expected in future data. Magellanic cloud and stream may rise in UHECR maps. UHECR should rise around Cas A and Cygnus, seen by T.A. in North sky. Recent unique doublet at highest AUGER and TA energy toward Aq X1 may be a new galactic source [26]. The UHECR spectra cut off maybe not indebt to the expected extragalactic GZK feature but to the more modest imprint of a galactic confinement and-or nuclei spectrography. The UHECR radioactive beta decay in flight may trace in new  $\nu_\tau$ , neutrino astronomy or anisotropy, noise free, related to astronomical (parasite oscillated) tau neutrino; boosted tau (*mini-double bang* [14], within a 5 meter size) in Deep Core may reveal hundred TeV tau decay (seeing similar PeV ones in ICECUBE [14] by tiny anisotropic shape of the cascade event). Also Tau airshowers may rise in Cherenkov beamed air-showers. [15], [13], as being searched in ASHRA experiment, [3] or in fluorescence telescopes for higher tau energies [13],[17],[18], [21].

## 6 Conclusions

The discover of TeVs-PeVs expected Neutrino astronomy may shed additional light on the UHECR nature, origination and mass composition, while opening our eyes to mysterious UHECR sources. Tau neutrino astronomy by upward airshowers as well as ICECUBE showering at PeV with no muon (indebted most probably to electron or tau cascade) [1] may also offer an additional windows for the first extraterrestrial neutrino traces , opening the road to desired High Energy Neutrino Astronomy. Their connection to UHECR radioactive decay in flight is a possibility to be test in future Cosmic ray anisotropy and UHECR maps.

## 7 Devoted

This article is devoted to the memory of the beloved young nephew Daniela Aielet Nur (Di Gioacchino-Fargion) born on 13rd December 1975 and very recently left on 24th July 2012.

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